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## EUROPEAN PATENT APPLICATION

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(71) Applicant:  
Shikoku Kakoki Co., Ltd.  
Itano-gun, Tokushima-ken 771-0202 (JP)

(72) Inventors:  
• Kume, Satoshi,  
c/o Shikoku Kakoki Co., Ltd.  
Itano-gun, Tokushima-ken 771-0202 (JP)

• Katayama, Hiroshi,  
c/o Shikoku Kakoki Co., Ltd.  
Itano-gun, Tokushima-ken 771-0202 (JP)  
• Ueda, Michio,  
c/o Shikoku Kakoki Co., Ltd.  
Itano-gun, Tokushima-ken 771-0202 (JP)

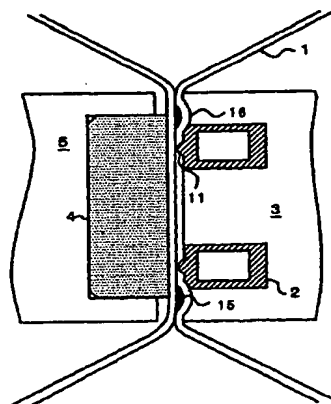
(74) Representative:  
de Bruijn, Leendert C.  
Nederlandsch Octrooibureau  
P.O. Box 29720  
2502 LS Den Haag (NL)

### (54) Heat-sealing apparatus

(57) To provide a heat-sealing apparatus capable of: achieving a complete sealing property by causing a liquid or dirt having entered small irregularities in a tube inner face to flow out of a sealed zone together with a molten resin; and a heat seal with no crack caused by the molten resin having flowed into a container and with an excellent compression strength.

A heat-sealing apparatus for forming a packing material (1) made of a laminate including a synthetic resin layer into a tubular-shape, and transversely heat-sealing the tubular packing material with fluid by using a sealing jaw (3) having a high-frequency coil (2) with a ridge (11) on its flat action face and a jaw (5) opposing to it, wherein a groove (16) is disposed on at least one action face of the high-frequency coil (2), capable of forming a synthetic resin bulge adjacent to the outer side of a zone to be sealed on a container's interior side.

Fig. 9



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## Description

[0001] The present invention relates to a heat-sealing apparatus for use in a filling/packing machine for producing liquid beverages or the like which are packed in paper containers so that they can be stored for a long time and, more particularly, to a sealing apparatus for transversely heat-sealing a tubular packing material filled with contents, such as liquid beverages, together with fluid.

[0002] Conventionally, when a packing container having a box shape filled with a liquid such as juice in a sealed manner is to be produced, as seen in Japanese Patent Publication No. 3215/1980, it is well known to use a sealing apparatus in which a packing material of a laminate of paper, aluminum foil and a synthetic resin is continuously formed into a tubular shape while conveyed, the tubular packing material 1 is transversely heat-sealed with fluid by using pressing means including a sealing jaw 3 having a high-frequency coil 2 and an opposing jaw 5 having a sealing rubber 4 of hard rubber as shown in Fig. 1, and it is cut between two sealed zones having been heat-sealed by a cutting blade 6.

[0003] In Publication of Japanese Patent application Laid-Open Nos. 134744/1983, 269854/1993, 164523/1995 and 218805/1996, there is further disclosed heat-sealing apparatus for heat-sealing a laminate material in which a ridge is formed on the action face of a high-frequency coil on a sealing jaw in the aforementioned heat-sealing apparatus so that molten resin is extruded into a sealed zone by the ridge.

[0004] In order to avoid a problem of the aforementioned heat-sealing apparatus that when molten resin is guided to flow toward the container's interior side of the sealed portion of a tubular packing material, corrugated molten resin beads are formed on the edge portion of the container's interior side so that cracks start from the crests of the beads to break the container when an external force is applied to the container, two magnetic members are arranged on the outer side (or the container's interior side) of the straight portions of a U-shaped high-frequency coil to leave the portion of the container inner side unheated, as disclosed in Japanese Patent No. 2571977.

[0005] In the Publication of Japanese Patent Application Laid-Open No. 230834/1996, it is described that in the aforementioned heat-sealing apparatus a high-frequency coil, which has a ridge in its longitudinal direction and grooves formed on the two sides of and in parallel with the ridge, causes melted resin to remain in the grooves without flowing out of a sealed zone, even if the resin on the packing material is melted and pushed by the ridge. It is further described in heat-sealing apparatus of the prior art having none of the aforementioned grooves that the molten resin having flowed out of a sealed zone solidifies to stick to the interior side of a packing container thereby to form cracks in a shaping process at and after the sealing step.

[0006] In the Publication of Japanese Patent Application Laid-Open No. 244728/1996, on the other hand, there is used a high-frequency coil which is inclined gradually at the more distance as the sealed zone forming portion goes to the outer side (to the container's interior side), so that the tube is heat-sealed whereby liquid and molten resin are discharged smoothly from the sealed zone to the container inner side, when the tube is pressed together with fluid.

[0007] In order to effect an excellent heat-sealing in sealing apparatus for transversely heat-sealing a tubular packing material filled with contents such as a liquid beverage in the presence of the liquid, it is necessary to exclude the liquid from the sealed zone of the tube as much as possible when the tube is sealed with heat and under pressure. However, the tube inner face in contact with the liquid is not completely flat and has small irregularities, if observed in detail. In the heat-sealing apparatus disclosed in the aforementioned Publication of Japanese Patent Application Laid-Open Nos. 134744/1983, 269854/1993, 164523/1995, 218805/1996 or 230834/1996, there is adopted the sealing method in which the molten resin can be prevented from flowing out of the sealed zone but is left in the sealed zone. Therefore, the liquid or dirt having entered the small irregularities in the tube inner face cannot be discharged to the outside of the sealed zone so that the sealing property cannot be said sufficient.

[0008] On the other hand, the inventors of this invention have found out that the liquid in the sealed zone may be guided to flow out together with the molten resin to the outside of the sealed zone so as to clear the liquid or dirt in the irregularities when sealed, and have completed the invention, as disclosed in the aforementioned Publication of Japanese Patent Application Laid-open No. 8-244728. The method using this heat-sealing apparatus can clear the liquid or dirt in the irregularities completely to provide an excellent sealing property, but the molten resin having flowed out to the container's interior side may not be homogeneously extruded. As shown in Fig. 2, undulating molten resin beads 7 are formed on the edge portion of the container's interior side. At a secondary step using a shaping machine after sealing step, it has been found out that cracks start from the crests 8 of the undulations of the beads 7 to cause a liquid leakage although not frequently when a pressure is applied to the container.

[0009] An object of the present invention is to provide a heat-sealing apparatus capable of solving the aforementioned problems of the heat-sealing apparatus in the prior art, that is, a heat-sealing apparatus capable of ensuring a sufficient fluidity of a resin without deteriorating the compression strength of the container. Specifically, the object is to provide a heat-sealing apparatus capable of: achieving a complete sealing property by causing a liquid or dirt having entered small irregularities in the tube inner face to flow out of the sealed zone together with the molten resin, and a heat seal with an

excellent compression strength which is free from cracks caused by the molten resin having flowed into a container's interior side.

[0010] The inventors of the present invention have developed a high-speed filling machine (Publication of Japanese Patent Application Laid-Open No. 86915/1998) provided with a sealing apparatus for transversely heat-sealing a tubular packing material, which is filled with contents such as a liquid beverage, together with fluid. The heat-sealing apparatus in this high-speed filling machine is not provided with a sealing jaw having both a heat-sealing portion and a cutting portion, unlike the aforementioned heat-sealing apparatus, but is provided with a cutting portion 10 for the step next to a sealing portion 9, as shown in Fig. 3. It follows, as shown in Fig. 4, that the heat-sealing apparatus used in the aforementioned high-speed filling machine is composed of a sealing jaw 3 having a high-frequency coil 2 and an opposed jaw 5 having a sealing rubber 4 but is not equipped with any cutting mechanism. In this heat-sealing apparatus 11, however, the pressure is applied to the whole face including a zone to be sealed so that the flow of the molten resin cannot be sufficient for achieving a complete seal. When the liquid having entered the small irregularities in the tube inner face is to be completely discharged together with the molten resin to the outside of the sealed zone, the flow is directed only to the container's interior side. With this inflow to the container's interior side, the corrugated molten resin beads are formed on the edge portion of the container's interior side. When an external force is applied to the container, cracks may start. Thus, it has been found that the heat-sealing apparatus of the prior art cannot achieve the complete seal in any event.

[0011] In order to solve such problems, first of all, the inventors of the present invention have performed a heat seal by using a heat-sealing apparatus, as shown in Fig. 5, which includes a groove 12 on the outer side of the cutting side of the high-frequency coil 2 having a ridge 11 and a magnetic member 13 on the outer side of the container inner side so as to cause the liquid having entered the aforementioned irregularities to flow out together with the molten resin to the cutting side. The fluidity of the molten resin has been improved, but this molten resin flows out to the cutting side so that the discharge of the liquid such as juice from the cutting portion is not sufficient. Thus, it has been found that the liquid bulge blots the cutter blade or the system itself to raise a new problem in the sanitary aspect such as fungus.

[0012] Therefore, the inventors of the present invention have reached a concept different from that of the heat-sealing apparatus of the prior art, that is, a concept of guiding the molten resin positively to flow out to the container's interior side. According to the finding, if a groove is formed adjacent to the outer side of a high-frequency coil on a container's interior side so that the molten resin is guided to flow into the groove, the fluidity of

the molten resin is improved. In addition, even if molten resin bead is formed but without any irregularity, no crack is formed against the external force applied to the container so that a complete heat seal can be achieved.

When this finding was applied to the heat-sealing apparatus having the cutting mechanism of the prior art, it has been found out that a complete heat seal can also be achieved to complete the invention.

[0013] The present invention relates to a heat-sealing apparatus for forming a packing material made of a laminate including a synthetic resin layer into a tubular-shape, and transversely heat-sealing the tubular packing material together with fluid by using a pair of open-and-closable pressing members having a heating mechanism characterized in that a groove is disposed on at least one action face of the pressing members, capable of forming a synthetic resin bulge adjacent to the outer side of a zone to be sealed on a container's interior side, and an above-mentioned heat-sealing apparatus characterized in that a laminate further has an aluminum foil layer, and a pair of open-and-closable pressing members having a heating mechanism includes a sealing jaw provided with a high-frequency coil having a flat action face and a jaw opposing to the sealing jaw.

[0014] The present invention further relates to said heat-sealing apparatus characterized in that a groove is formed adjacent to the outer side of a high-frequency coil having a flat action face on a container's interior side, or formed over a portion of a container's interior side and its outer side of a high-frequency coil having a flat action face; the groove is formed on the two outer sides of the high-frequency coil having a flat action face; a groove is formed adjacent to the outer side of the cutting side of a high-frequency coil having a flat action face in addition to it is formed on the container's interior side of that; and a groove is arcuate in cross section having a depth smaller than one half of the width.

[0015] Furthermore, the present invention relates to said heat-sealing apparatus characterized in that a high-frequency coil having a flat action face has a ridge wholly or partially in its length; and pressing members further include a cutting mechanism.

[0016] The packing material made of the laminate including the synthetic resin layer in the invention can be exemplified by a laminate which is composed of: a synthetic resin layer such as polyethylene to be heat-sealed by heating means to the innermost face; a paper sheet for keeping the rigidity of the container; and an aluminum foil layer or a synthetic resin film layer impermeable to air or bacteria into the container. When a heating mechanism utilizing high frequencies is adopted, the laminate including the aluminum foil layer is used. When the heating mechanism adopted utilizes impulses or ultrasonic waves, the aluminum foil layer is not indispensable, but a laminate including an oxygen-impermeable synthetic resin film layer can be used.

[0017] In the invention, the sealed zone is a portion

which is heat-sealed by applying a heat and a pressure to the innermost face synthetic resin layer of the packing material by using a pair of open-and-closable pressing members having a heating mechanism. One of end portions in a direction crossing to the longitudinal direction of the sealed zone in right angle makes a side of a content such as juice, i.e., the container's interior side, and the other end portion makes a cutting side for cutting containers one by one. Additionally, in this invention, an action face of pressing members corresponding to the sealed zone will be conveniently called a zone to be sealed.

**[0018]** The heating mechanism for the pressing members in the invention can be exemplified, as described hereinbefore, by the heating mechanism using high frequencies, impulses and ultrasonic waves. In the heat seal using high frequencies, however, the boundary between the heated region and the unheated region is more heterogeneous than the heat seal using ultrasonic waves or the like so that the boundary of the sealed zone has a tendency to become heterogeneous. However, by providing the groove on the outer side of a zone to be sealed as in the invention, the resin bulge to be formed is straight but not irregular so that the boundary of the sealed zone is homogeneous. If high frequencies are used for the heating mechanism of the pressure members in the invention, therefore, it is advantageous that the effects of the invention can be enjoyed in particular.

**[0019]** In the invention, as a heat-sealing apparatus for forming a packing material into a tubular-shape, and transversely heat-sealing the tubular packing material, which is filled with contents such as juice, from its outside by using a pair of open-and-closable pressing members having a heating mechanism, the aforementioned heat-sealing apparatus of the prior art can be used except a groove formed on its pressing member. A pair of pressing members in this heat-sealing apparatus is generally composed of a pressing member having (as will be called a "sealing jaw") equipped with a heating portion using the impulses or a heating source using high frequencies or ultrasonic waves, and a pressing member (as will be called a "opposing jaw") without the heating portion or the heating source. However, a pair of pressing members could be exemplified by one pressing member having a heating portion using impulses and the other having a heating source using ultrasonic waves.

**[0020]** Moreover, the heat-sealing apparatus of the invention is characterized in that a groove is disposed on at least one action face of the pressing members, capable of forming a synthetic resin bulge adjacent to the outer side of a zone to be sealed on a container's interior side. This groove may be formed in the action faces of both a pair of pressing members, either in the action face of one of a sealing jaw or an opposing jaw. In the latter case, the groove is usually arranged in the action face of the sealing jaw.

**[0021]** In the invention, in case the packing material is exemplified by the laminate including the synthetic resin layer and the aluminum foil layer and in case a pair of open-and-closable pressing members having the heating mechanism are exemplified by the sealing jaw having a high-frequency coil having a flat action face and an opposing jaw having a sealing rubber, the aforementioned groove is desirably formed adjacent to the outer side of a high-frequency coil having a flat action face on a container's interior side, or formed over a portion of a container's interior side and its outer side of a high-frequency coil having a flat action, preferably into an arcuate shape in cross section having a depth of one half or less of the width, such as about one third.

**[0022]** With this groove, the synthetic resin layer on the innermost face of the packing material in a zone to be sealed is melted by the action of the pressing members having the heating mechanism so that the molten resin is extruded together with the contents such as juice or the foreign substances such as dirt having stuck to the synthetic resin layer surface toward the container's interior side. The resin having flowed out of the sealed zone flows into the groove so that the synthetic resin bulge is formed adjacent to the outer side of the zone to be sealed on a container's interior side. Therefore, a thin synthetic resin layer having no foreign substance and an excellent sealing property is formed in the sealed zone.

**[0023]** Additionally, the width and depth of the groove are desirably set such that the groove is filled up with the resin having flowed out of the sealed zone to form the synthetic resin bulge having a straight seal edge and a uniform width with no irregularity. Then, no crack starts from that synthetic resin bulge having the uniform width. Moreover, this synthetic resin bulge will not contribute to the sealing property so much because it contains the foreign substances, as described hereinbefore, but can be said to enhance the sealing strength.

**[0024]** When the sealing jaw is equipped with a high-frequency coil having a U shape or the like to heat-seal the tubular packing material simultaneously at two portions through a portion to be cut, two grooves are preferably formed, for example, in the two outer sides of the high-frequency coil having the flat action face, that is, in the outer sides on the two container's interior sides.

**[0025]** In the invention, a groove can also be formed adjacent to the outer side of the cutting side in addition to the container inner face side of the high-frequency coil having the flat action face. This groove, as formed adjacent to the outer side of the cutting side, is disposed adjacent to the heating region so that the molten resin having been extruded from the sealed face, flows into that groove, too. By forming the groove, when the synthetic resin layer on the innermost face of the packing material in the zone to be sealed is melted, a portion of the molten resin in the zone to be sealed is forced to flow toward the cutting side into the groove thereby to

form the synthetic resin bulge adjacent to the outer side of the cutting side, so that one thin synthetic resin layer having no foreign substance is formed in the sealed zone. Moreover, the synthetic resin bulge thus formed adjacent to the outer side of the cutting side is not required unlike that of the outer side on the container's interior side to have a uniform thickness having the straight sealed edge but no irregularity.

[0026] Moreover, it is preferable for reliably preventing the sealing defect, as might otherwise be caused by a tunnel formed by creases existing in advance in the packing material, that the ridge is formed partially in the longitudinal direction of the aforementioned high-frequency coil having the flat action face. However, the ridge may be formed wholly in the longitudinal direction of the high-frequency coil. Further, the location to form the ridge can be suitably selected to be near the container's interior side or the cutting side, if it is within the zone to be sealed. Furthermore, the heat-sealing apparatus of the invention may be equipped at its pressing members with the cutting mechanism as in the heat-sealing apparatus of the prior art.

[0027] A heat-sealing apparatus according to the invention will be described with reference to Figs. 6 to 11, but the invention should not be limited to the disclosure of those Figures.

[0028] The heat-sealing apparatus of the invention, as shown in Figs. 6 to 11, employs a laminate of a synthetic resin layer and an aluminum foil layer as a packing material 1, and is equipped with a pair of open-and-closable pressing members having a heating mechanism. These pressure members are composed of a sealing jaw 3 equipped with a high-frequency coil 2, with a flat action face, having a cooling water passage 14 therein, and an opposing jaw 5 having a sealing rubber 4. In the sealing jaw 3, there is formed a groove 16 capable of forming a synthetic resin bulge 15 adjacent to the outer side of a zone to be sealed on a container's interior side.

[0029] In a heat-sealing apparatus shown in Fig. 6, moreover, the groove 16 is formed over a portion of a container's interior side and its outer side of the high-frequency coil 2 having the flat action face. In a heat-sealing apparatus shown in Fig. 7, the groove 16 is formed adjacent to the outer side of the high-frequency coil 2 having the flat action face on a container's interior side. Further, Fig. 8 depicts a heat-sealing apparatus in which a groove 12 is formed adjacent to the outer side on the cutting side in addition to the groove 16 formed on the container's interior side of the high-frequency coil 2 having the flat action face. In Figs. 9 to 11, there is shown a heat-sealing apparatus, which has a ridge 11 on the flat action face of the high-frequency coil 2 of the heat-sealing apparatus shown in Figs. 6 to 8. In Fig. 12, still further, there is shown a heat-sealing apparatus in which the two grooves 16 formed on the container's interior side are disposed on the two outer sides of the high-frequency coil 2 having the flat action face.

[0030] According to the invention, the liquid bulge of the cutting portion can be reduced to produce more sanitary packs. Moreover, the molten resin having flowed out of the sealed zone together with the foreign substances forms a resin bulge of a uniform width so that no crack starts from that portion, and the sealed zone can be cleared of the foreign substances so that excellent heat seals can be achieved.

## 10 Claims

1. A heat-sealing apparatus for forming a packing material made of a laminate including a synthetic resin layer into a tubular-shape, and transversely heat-sealing the tubular packing material with fluid by using a pair of open-and-closable pressing members having a heating mechanism, characterized in that a groove is disposed on at least one action face of the pressing members, capable of forming a synthetic resin bulge adjacent to the outer side of a zone to be sealed on a container's interior side.
2. A heat-sealing apparatus according to Claim 1, wherein a laminate further has an aluminum foil layer, and a pair of open-and-closable pressing members having a heating mechanism includes a sealing jaw provided with a high-frequency coil having a flat action face and a jaw opposing to the sealing jaw.
3. A heat-sealing apparatus according to Claim 2, wherein a groove is formed adjacent to the outer side of a high-frequency coil having a flat action face on a container's interior side, or formed over a portion of a container's interior side and its outer side of a high-frequency coil having a flat action face.
4. A heat-sealing apparatus according to Claim 3, wherein a groove is formed on the two outer sides of a high-frequency coil having a flat action face.
5. A heat-sealing apparatus according to Claim 3 or 4, wherein a groove is formed adjacent to the outer side of the cutting side of a high-frequency coil having a flat action face.
6. A heat-sealing apparatus according to any of the Claims 3 to 5, wherein a groove is arcuate in cross section having a depth smaller than one half of the width.
7. A heat-sealing apparatus according to Claim 2 or 6, wherein a high-frequency coil having a flat action face has a ridge wholly or partially in its length.
8. A heat-sealing apparatus according to any of the

Claims 1 to 7,  
wherein pressing members further include a cutting  
mechanism.

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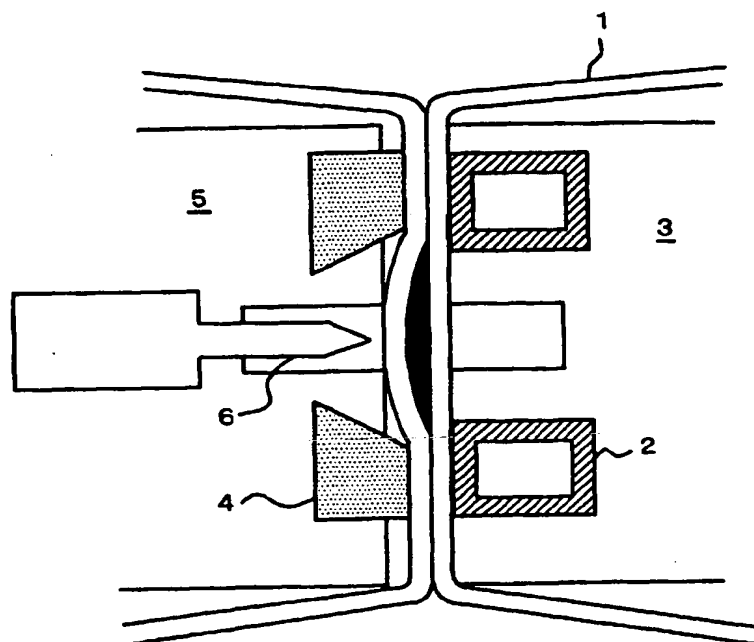
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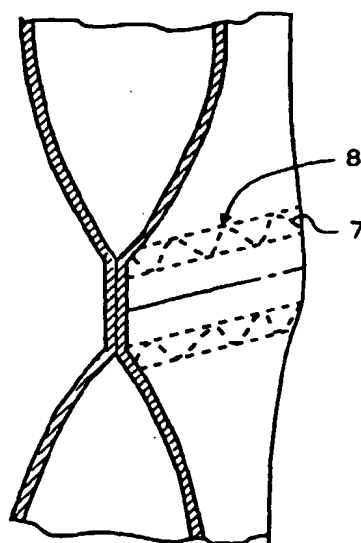
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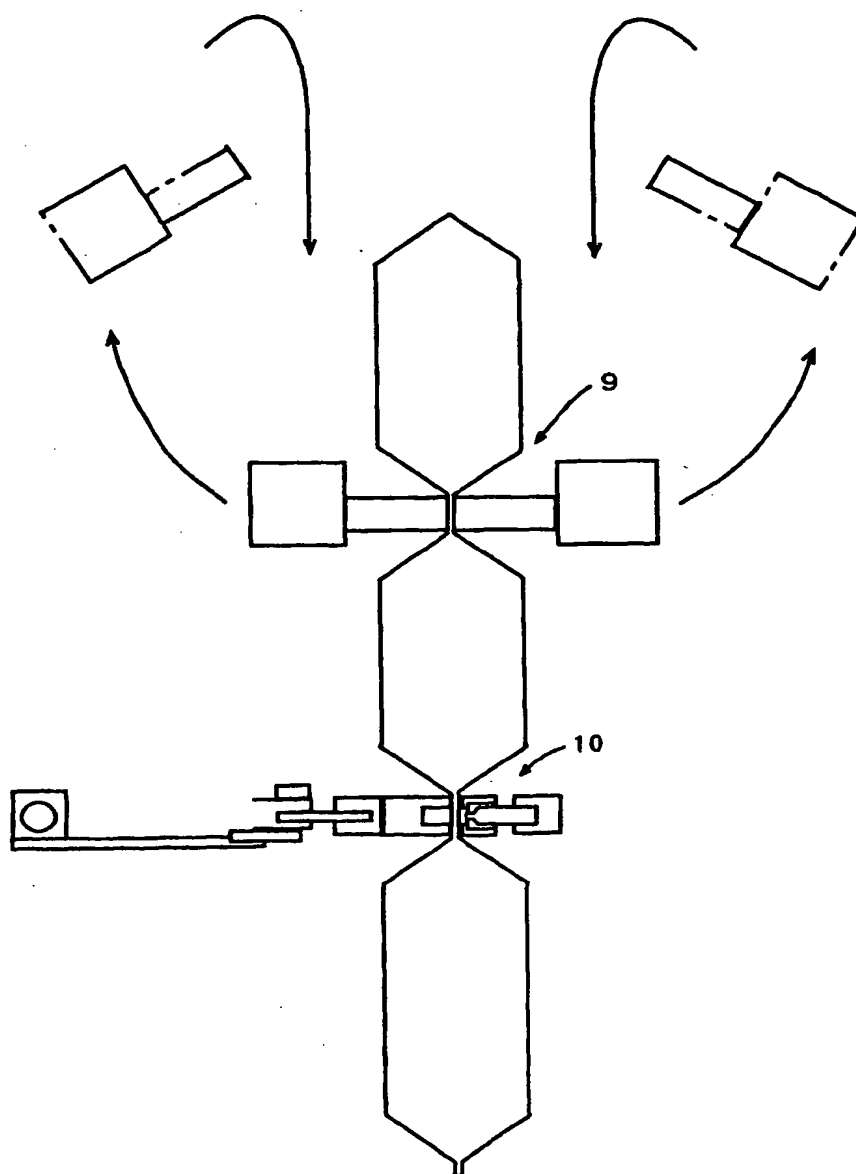
f i g . 1 (PRIOR ART)



F i g . 2 (PRIOR ART)

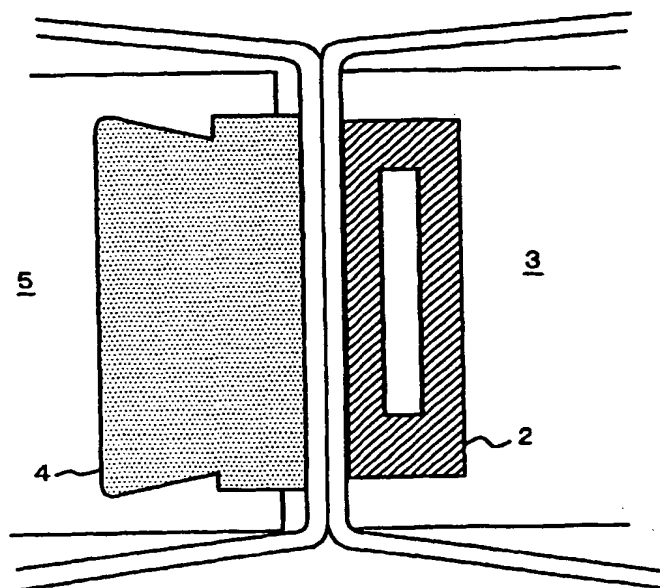


F i g . 3 (PRIOR ART)





F i g . 4 (PRIOR ART)



F i g . 5 (PRIOR ART)

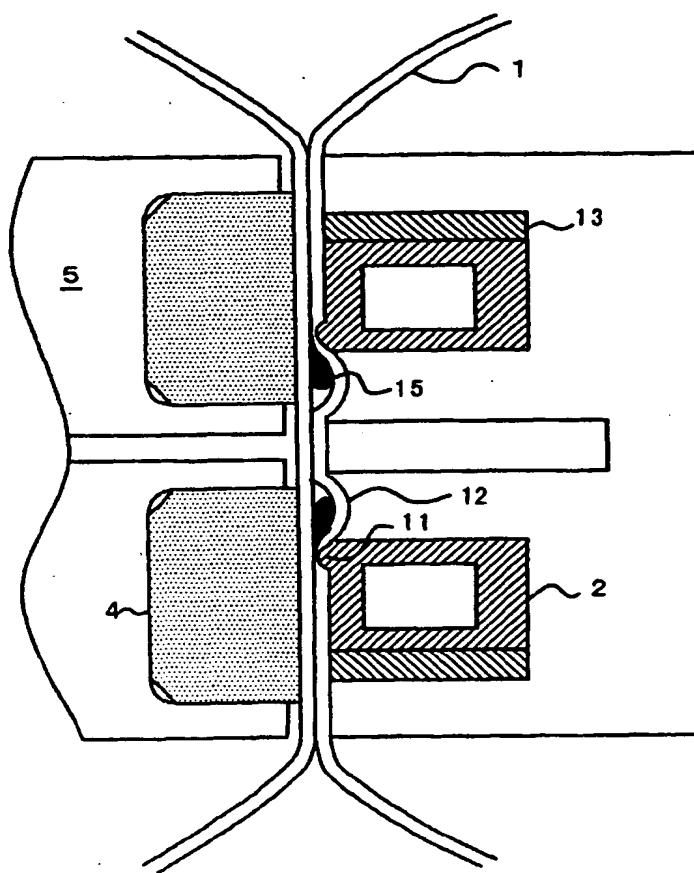


Fig. 6

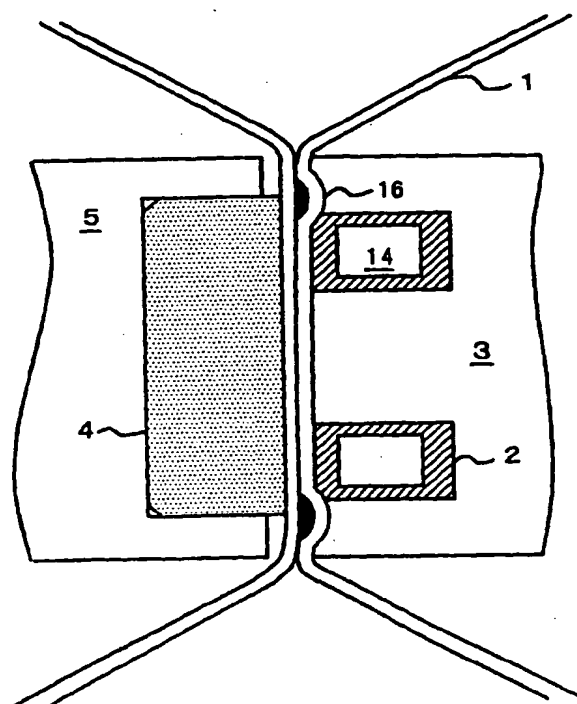


Fig. 7

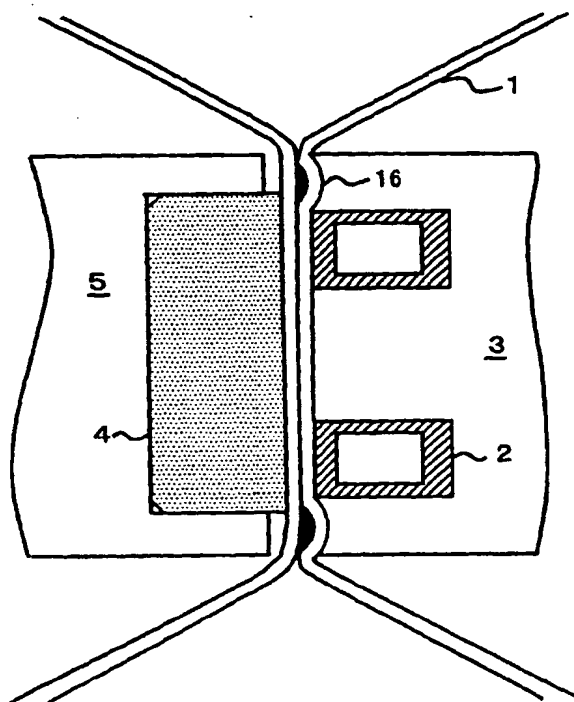


Fig. 8

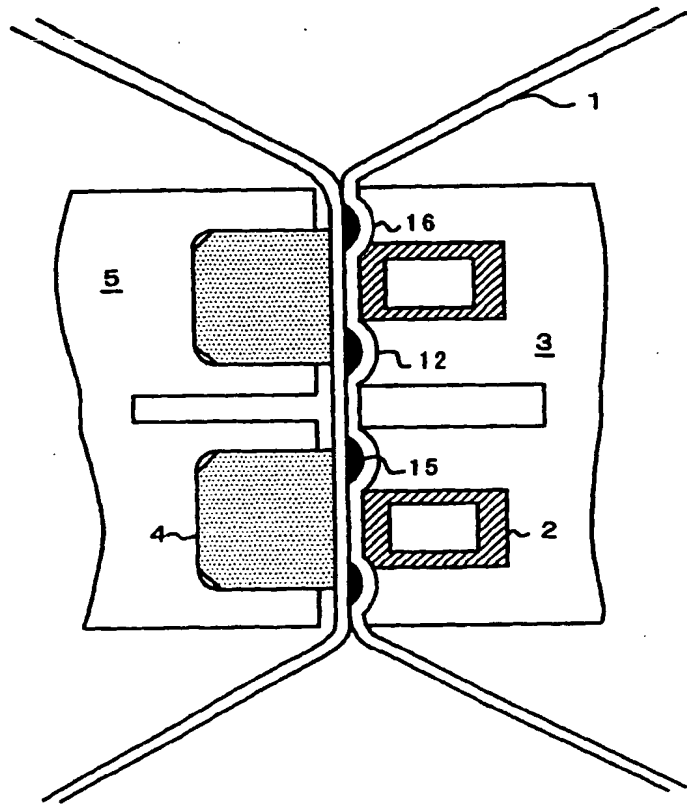


Fig. 9

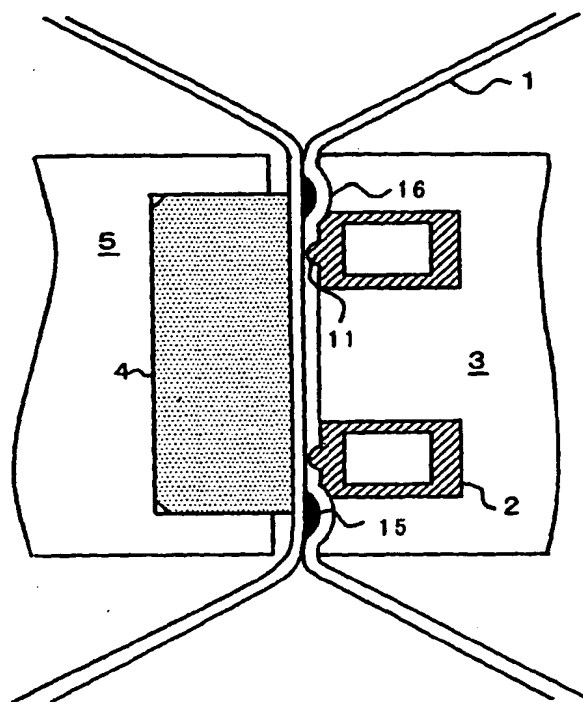


Fig. 10

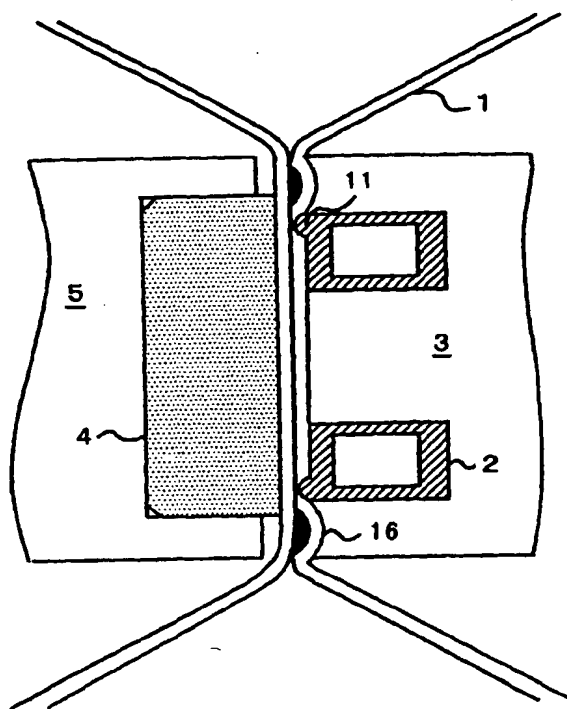


Fig. 11

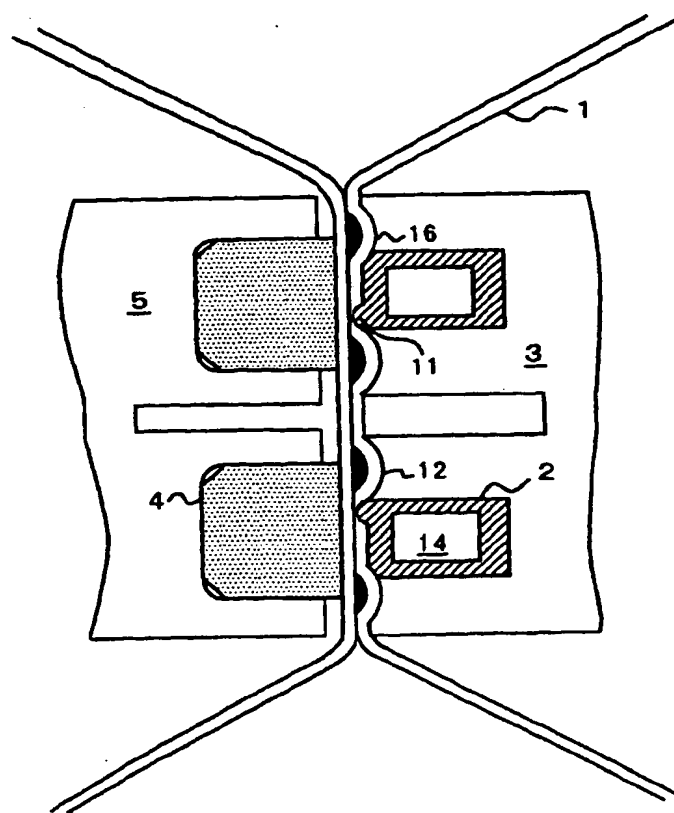
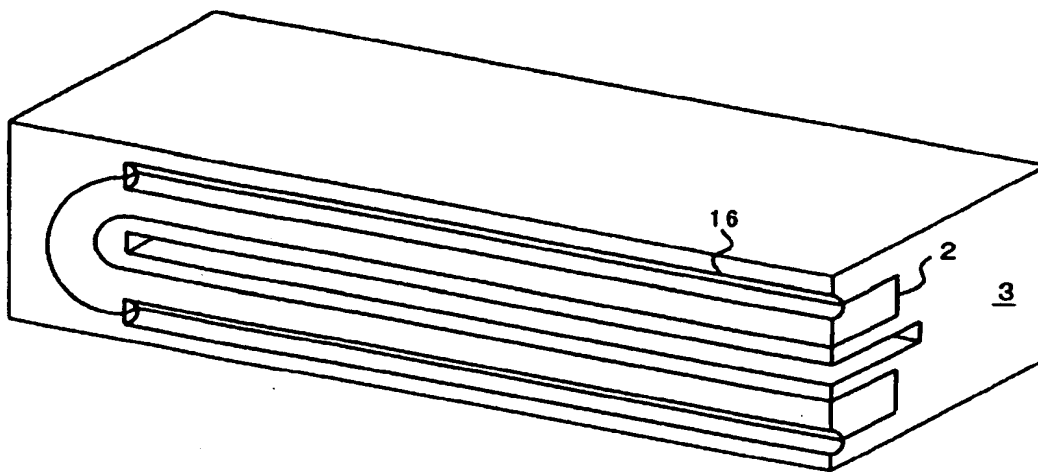
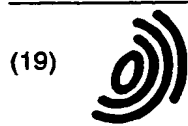




Fig. 12







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(71) Applicant: Shikoku Kakoki Co., Ltd.  
Itano-gun, Tokushima-ken 771-0202 (JP)

(72) Inventors:  
• Kume, Satoshi, c/o Shikoku Kakoki Co., Ltd.  
Itano-gun, Tokushima-ken 771-0202 (JP)  
• Katayama, Hiroshi, c/o Shikoku Kakoki Co., Ltd.  
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Itano-gun, Tokushima-ken 771-0202 (JP)

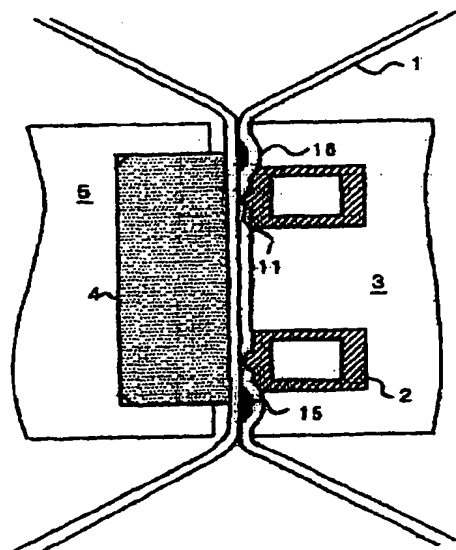
(74) Representative: de Bruijn, Leendert C.  
Nederlandsch Octrooibureau  
P.O. Box 29720  
2502 LS Den Haag (NL)

### (54) Heat-sealing apparatus

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A heat-sealing apparatus for forming a packing material (1) made of a laminate including a synthetic resin layer into a tubular-shape, and transversely heat-sealing the tubular packing material with fluid by using a sealing jaw (3) having a high-frequency coil (2) with a ridge (11) on its flat action face and a jaw (5) opposing to it, wherein a groove (16) is disposed on at least one action face of the high-frequency coil (2), capable of forming a synthetic resin bulge adjacent to the outer side of a zone to be sealed on a container's interior side.

Fig. 9



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European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 99 20 2615

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 01, 31 January 1997 (1997-01-31) & JP 08 230834 A (NIPPON TETRA PACK KK), 10 September 1996 (1996-09-10) * abstract *	1-8	B29C65/02 B65B51/22 B65B9/12 B65B51/30 B29C65/00 //B29L9:00
X	DE 12 79 320 B (HERFURTH) 3 October 1968 (1968-10-03) * column 2, line 44 - column 3, line 10; claim 1 *	1	
X,P	US 5 868 901 A (SMITH LARRY E) 9 February 1999 (1999-02-09) * the whole document *	1,6,8	
A	FR 2 079 944 A (SCOTTO JEAN PIERRE) 12 November 1971 (1971-11-12) * the whole document *	1,8	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B65B B29C
The present search report has been drawn up for all claims			
Place of search <b>MUNICH</b>		Date of completion of the search <b>17 January 2002</b>	Examiner <b>Foulger, C</b>
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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